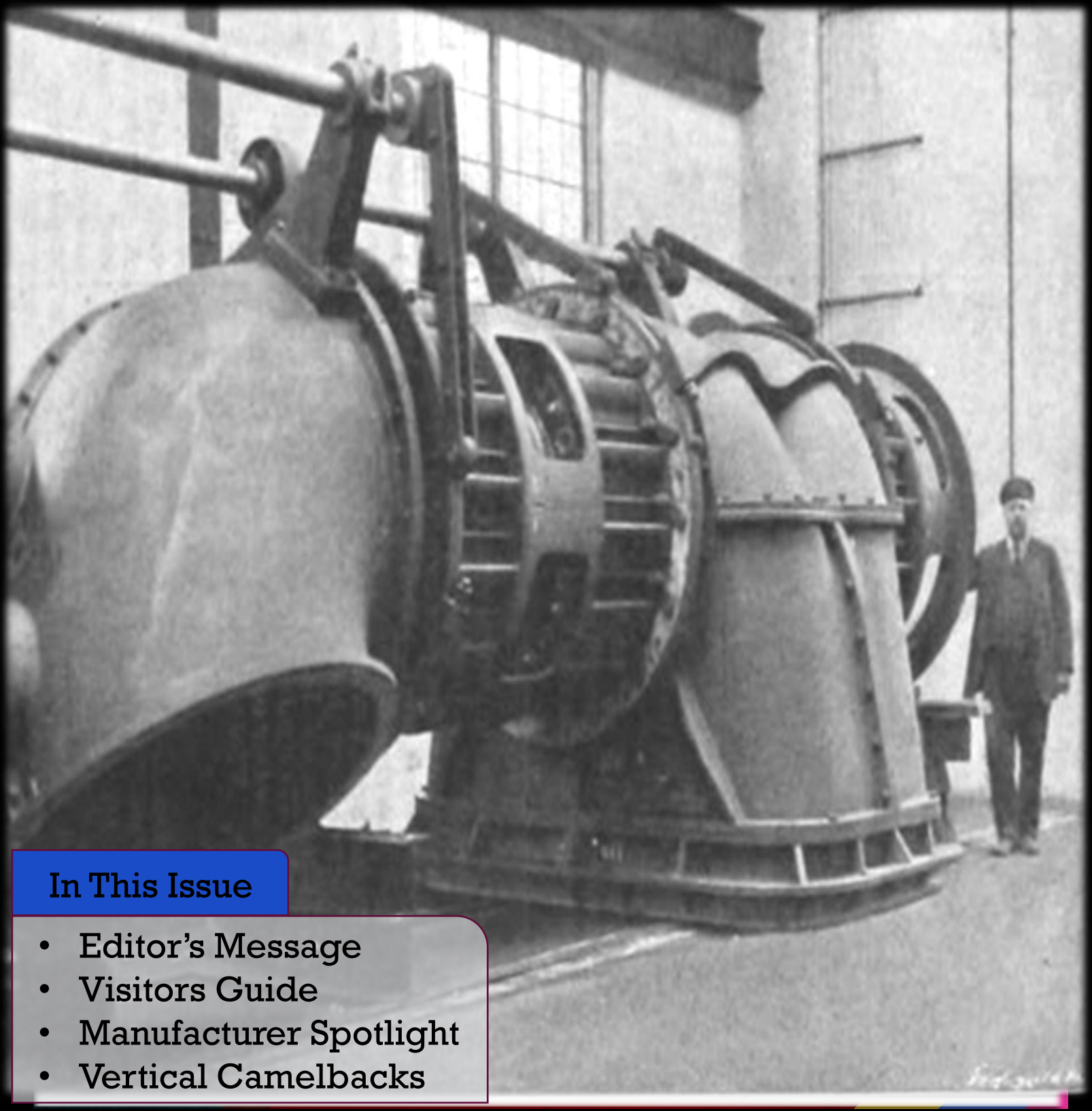
Winter 2025

TURBINE TOPICS

Volume 1 Issue 1



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Editors Message

Turbine Topics

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What's in a name? This familiar line in the production of Romeo and Juliet is a fitting question as we undergo a relaunch of Turbine Topics. There are a handful of high-quality and expertly produced publications out there highlighting the future and modern-day accomplishments of the hydropower industry. But there is much to celebrate about where the industry came from. So with this publication, we strive to preserve and remember the marvels of the past, with a little hope that it might inspire our industry's future. So, with great respect, we go forth again with the name Turbine Topics. This name originated as the title of the internal publication of hydropower news for the S. Morgan Smith Co. of York, PA. As we remember legacies of great accomplishments in waterpower, feel free to reach out with subjects of interest, history, or unique expertise that you find interesting.

Visitors Guide

Located in southern York County is the Wallas-Cross Mill, a well-preserved piece of pre-industrial waterpower history. This mill, with its overshot waterwheel, dates back to 1826. The Wallis-Cross mill prepared and ground grain for the local community for many decades. The site still features an operable set of millstones and an overshot wheel to actively demonstrate the milling process during the warmer months of the year. The interior of the mill has been restored to be period correct and features many mechanical elements and tools of the milling trade for your inspection. Though the location is a bit isolated, it is still a very enjoyable place to visit if you are in the area. Please see the website of the York County Parks Service for the upcoming 2026 schedule of events.

Managed by: York County Parks Service
Address: 15759 Cross Mill Rd, Felton, PA 17322
Tours Available: May-Oct.

Manufacturer Spotlight

In the early days of hydropower, the industrial marketplace was saturated with ads for water-powered turbines. Publications dedicated to power generation, textiles, farming, and milling were graced with beautifully drawn ads with each different manufacturer claiming to have the best turbine on the market. But as time went by and for various reasons, the number of manufacturers has dwindled to only a small number of the most innovative and nimble survivors, some with deep roots in the industry. But it is still worth looking back; the creativity, innovation, and efforts of these industrial pioneers are not without merit and have helped pave the way to where we are today. This leads us to today's Manufacturer Spotlight, The Christianna Machine Co.

Manufacturer Spotlight

Humble Beginnings:

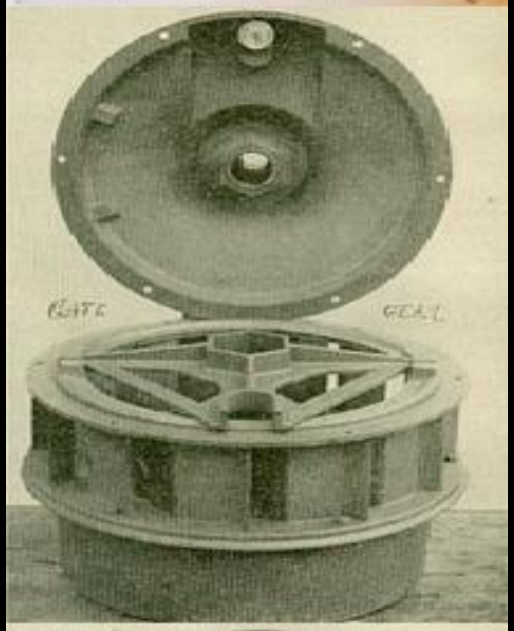
The Christianna Machine Co. operated under various names and owners during its operations and evolution as a manufacturer. Beginning in 1833, a foundry was established in the small town of Christianna, PA; the small foundry was the vision of resident William Noble. Noble's foundry made an array of farm and industrial cast components. Noble's enterprise was short-lived and operated for a mere ten years before closing and becoming abandoned by 1844. The facility would reopen and return to useful operation a few short years later in 1846 under new ownership. Over the next 17 years, the facility would continue to operate while changing ownership an additional 5 times before coming under the ownership of Issac Broomell in April of 1863. Broomell and his son Isac, reopened the foundry in 1864. The now prosperous foundry once again manufacturing tools and farm implements. In 1868, arrangements were made with the well-established turbine manufacturer N.F Burnham of York, PA. The foundry contracted with Burnham to make and sell a portion of his turbines in their Christianna facility. The Burnham Brothers had also contracted the rights to build and sell their turbines to the well-known Fitz Water Wheel Co. of Hanover, PA. This network contributed to installations across the eastern states and occasionally beyond, sharing near-identical designs but sold under different names.

Manufacturer Spotlight

Equipment Offerings

The CMC offerings expanded in the hydro division as the market continued to grow and flourish. CMC began to offer a wide array of turbine configurations for almost any application that could be devised. The retrofitting of mills and small manufacturing facilities comprised most of the market for CMC. A wide selection of arrangements was offered, including equipment builds for use with penstocks (wood or steel), encased/chambered units, and dual-runner configurations in a range of sizes to suit the user's needs.

Burnahm's design featured a unique gate/ register design with very few individual or moving parts compared to their competition. This configuration featured an inner gate or chute ring that rotated within an outer ring of additional stationary vanes. When rotated within the outer ring, the openings aligned to allow water to pass through to the turbine. The gate ring was actuated by a geared gate ring operator with three arms and was cast as part of a single piece, further simplifying the design. The assembly was then covered with a streamlined cap for protection. While I cannot speak of the efficiency of this design, I can admire its simplicity.



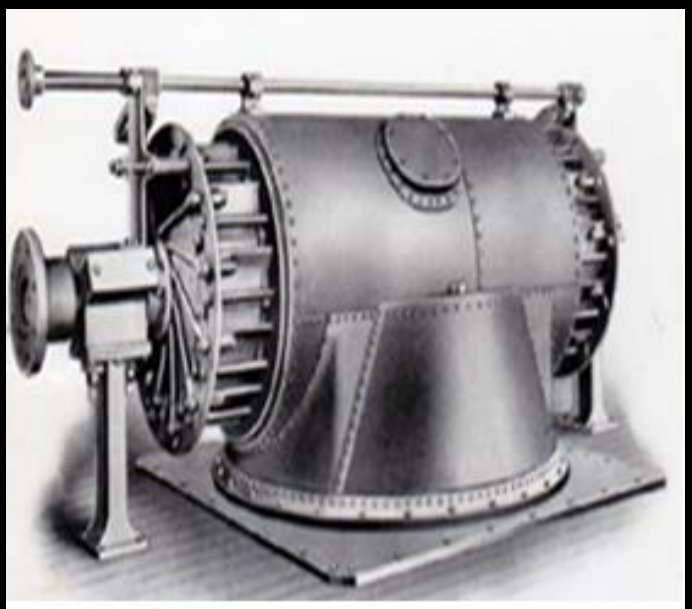
Manufacturer Spotlight

End of an era

While industry and sales thrived for a number of years, CMC would eventually succumb to the pressures of evolving industry needs. As technology and demand advanced, larger hydroelectric facilities began to emerge. With small rural power plants and mills on the decline, the customer base of CMC also began to dwindle. While other industrialists such as S. Morgan Smith and Leffel stayed proactive and scaled up their size capabilities, CMC did not, leading to their eventual withdrawal from the turbine marketplace. CMC would carry on for several years as the small turbine market contracted, eventually being purchased by and operated as "Bond Co." in 1915. Bond Co. continues manufacturing activities and performs custom fabrication work to this day, and is still alive and well today in Christianna, PA, and the surrounding areas.

Multi-turbine solutions

Cammel back turbines, depending on your experiences, you either love them or hate them. Regardless, the concept behind the design is straightforward: if you have a lower available head but plenty of flow, utilizing multiple turbines simultaneously can help you develop the power that you are looking for. Normally, when we think of camelbacks, we think of the well-known double-horizontal and quad configurations shown here. However, other unique configurations utilize multiple turbines to generate mechanical power. While utilizing multiple runners is a unique idea, today we explore the more curious variants where multiple runners were situated on a common vertical shaft.



Top: Leffel Turbine
Bottom: Norcan mockup

Vertical Camelback's

Vertical camelback units are a bit of a rarity and are widely unknown to those outside of the very few facilities that are still home to these units. For the time, vertical camelback units had their benefits. Building vertically could allow for a narrower overall powerhouse in applications where space is limited. From a water usage standpoint, in low-head applications, more flow could be utilized to make up for available head limitations.

While this was not a hugely popular option, multiple manufacturers such as S. Morgan Smith, I.P Morris, Maschinenfabrik Esslingen, Escher Wyss, Alice Chalmers, and likely others at different points in time all constructed their own versions of this unique design.

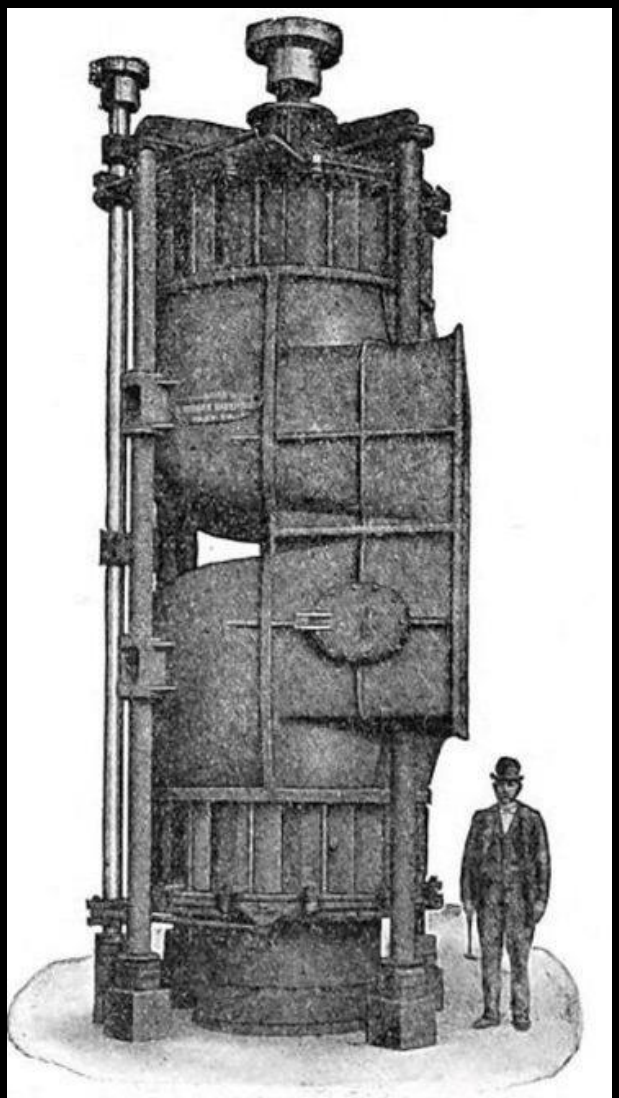


Fig. 326.—Double Vertical Unit Built by the S. Morgan Smith Co.

Interesting History:
A double turbine was utilized in a unique mining application as a forward / reversing method. Water was directed by a gate to either the upper CW or lower CCW turbine to reverse the direction of shaft rotation.

Vertical Camelback's

While from manufacturer to manufacturer, the general builds were similar in nature, the number of turbines installed at different locations varied, with most applications having two or three turbines per shaft. It is not beyond the realm of possibility that there were installations out there that may have gone as far as using four turbines, a wild concept.

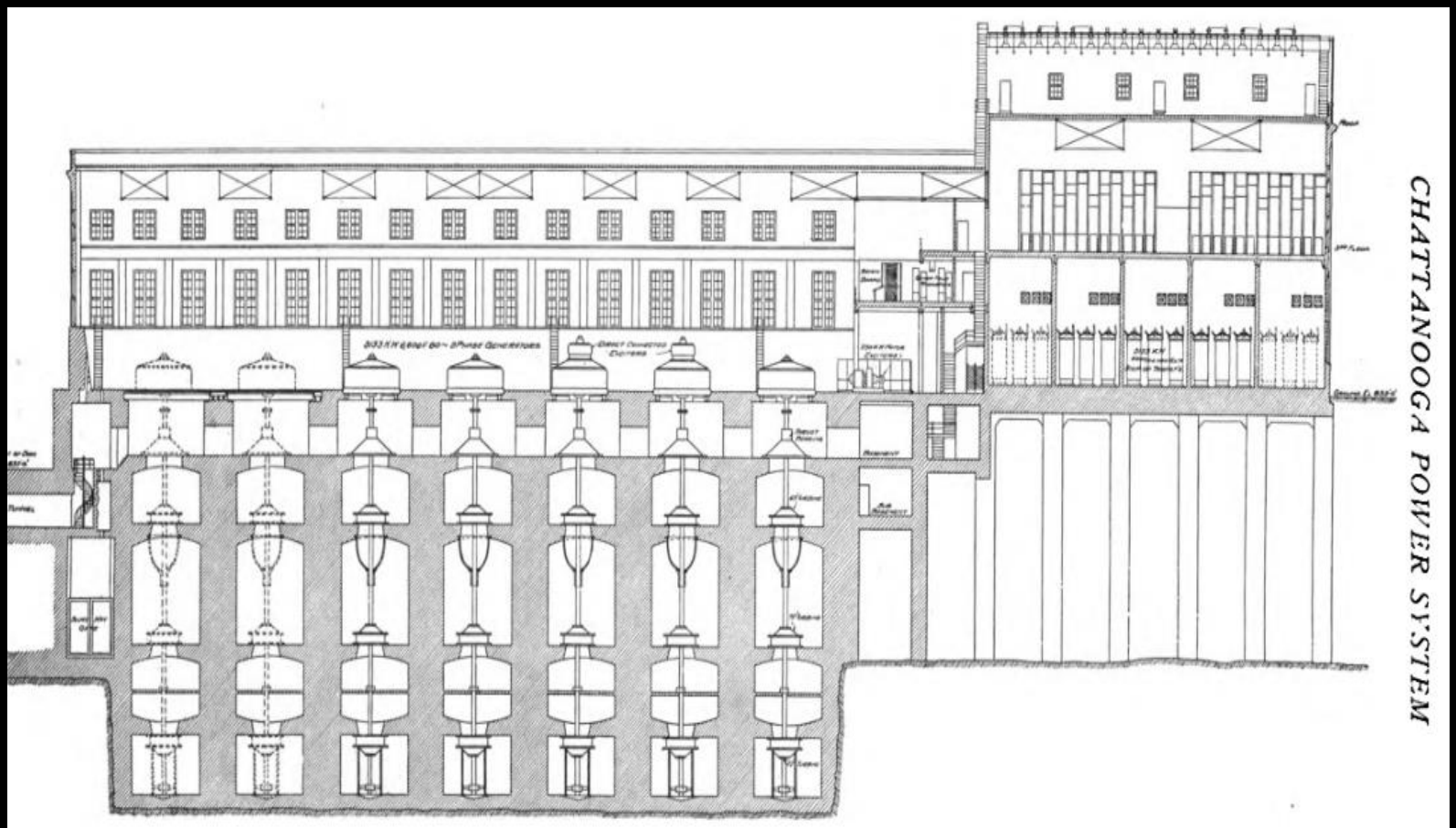


Fig. 108.—Longitudinal Section D-D, Hales Bar Station, Chattanooga & Tennessee River Power Co. (See Fig. 107.)

Vertical Camelback's

So, what facilities used vertical turbines in this fashion? While this was a difficult topic to research, it did yield some results, though I suspect there are more of these historic marvels out there. From my research, a handful of facility profiles were located showing these unique installations, all of which are a bit curious in their own way. So please enjoy a collection of facility cutaways of these interesting feats of engineering.

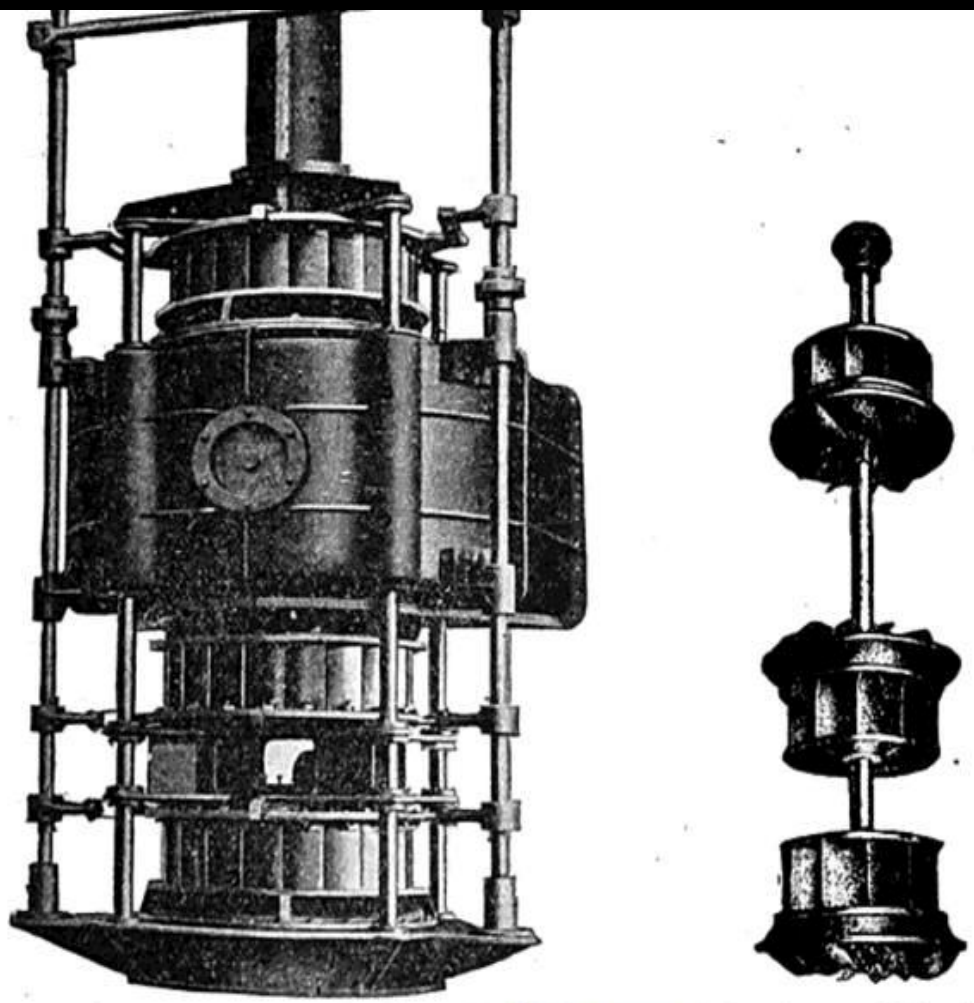
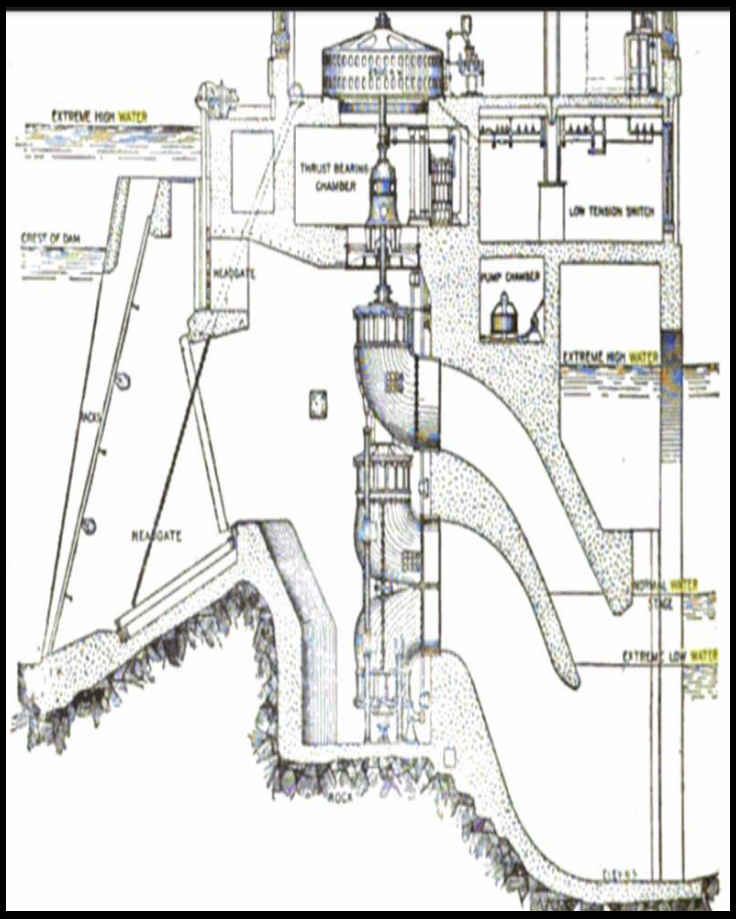
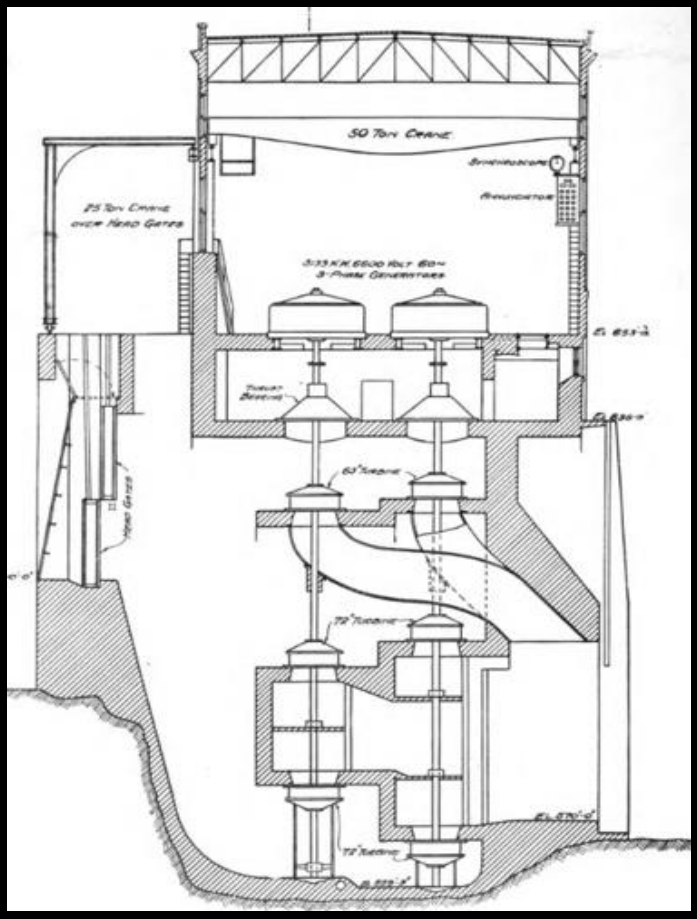


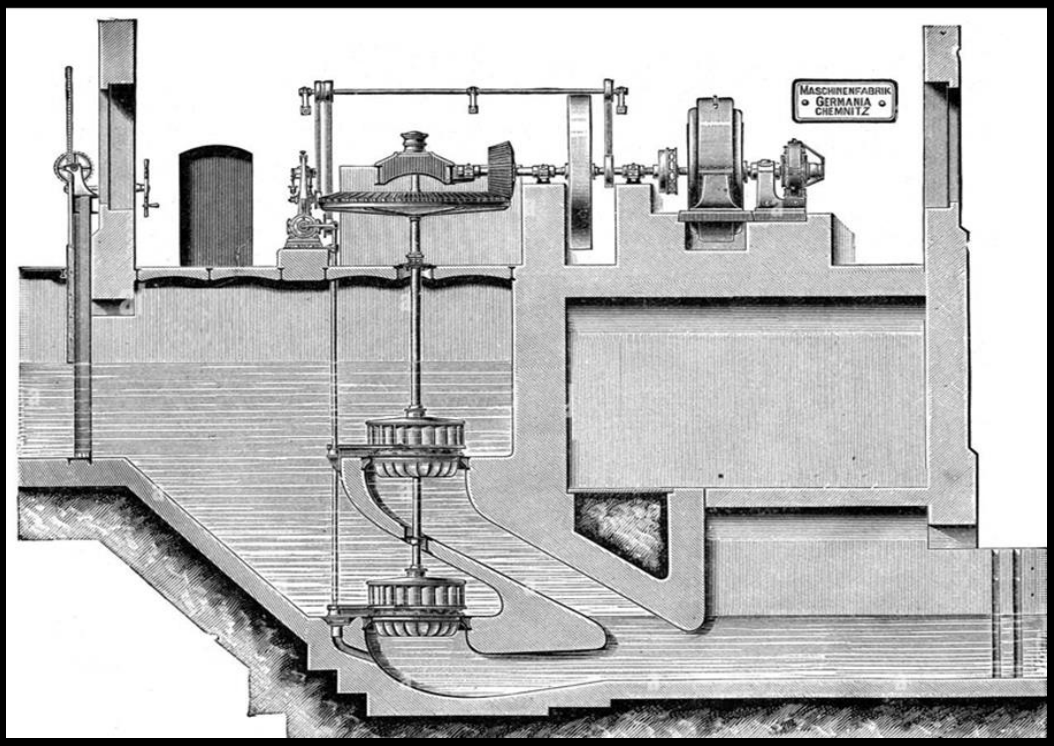
Fig. 325.—Vertical Turbine for Sewall's Falls Plant of the Concord Electric Co. (see page 516).



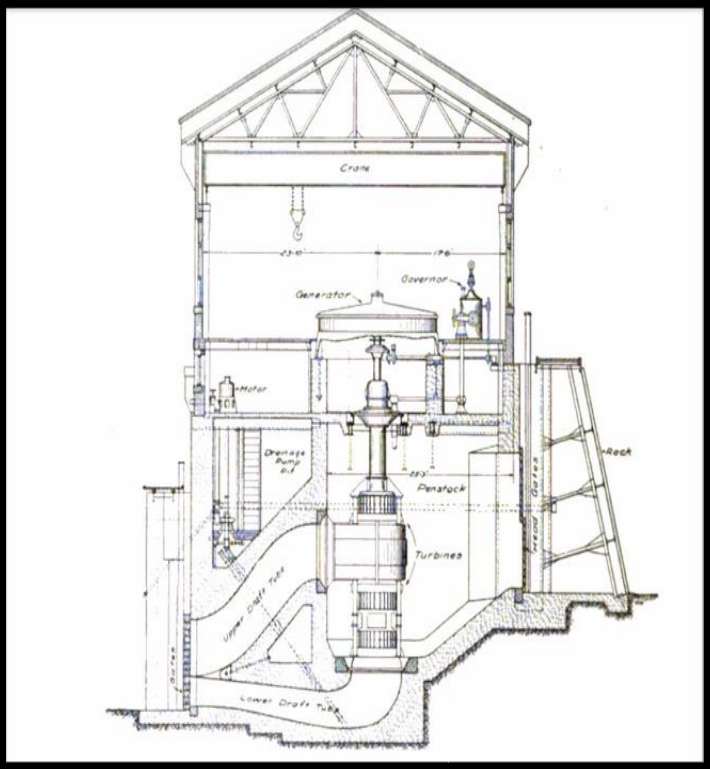
Philadelphia Hydro Electric Co. , PA



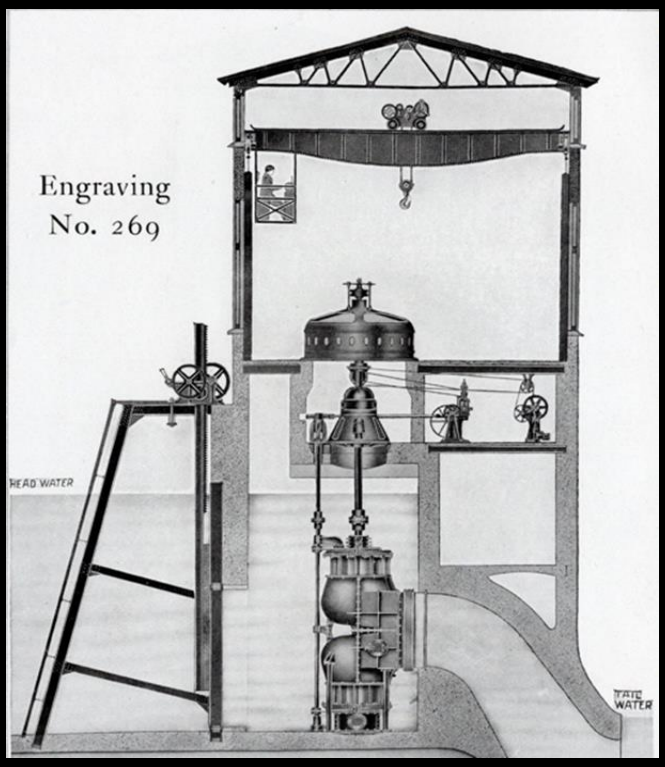
Hales Bar, Tenn.



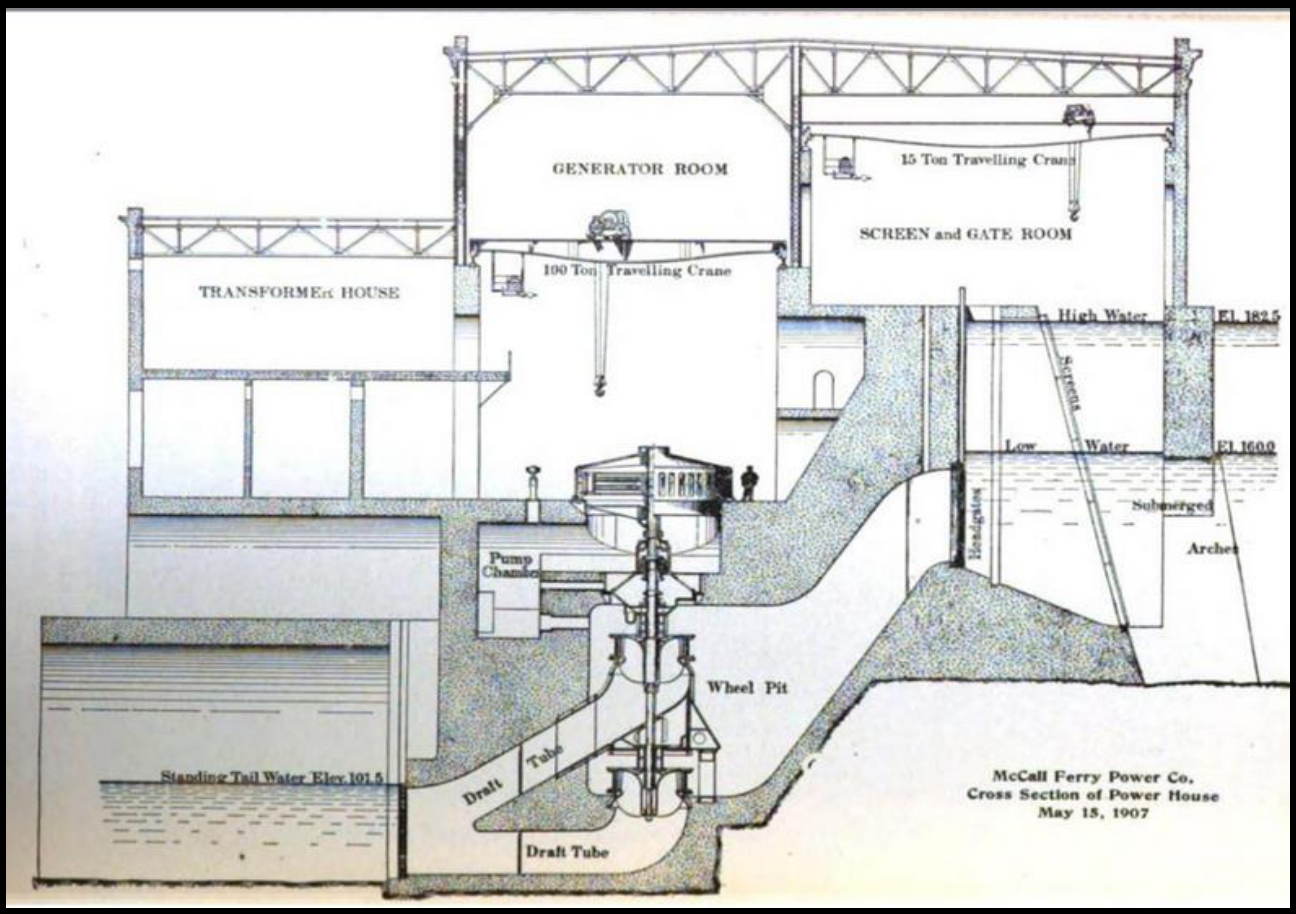
Unknown Facility Germany



Seawalls's Hydro Station,
Concord Electric Co.



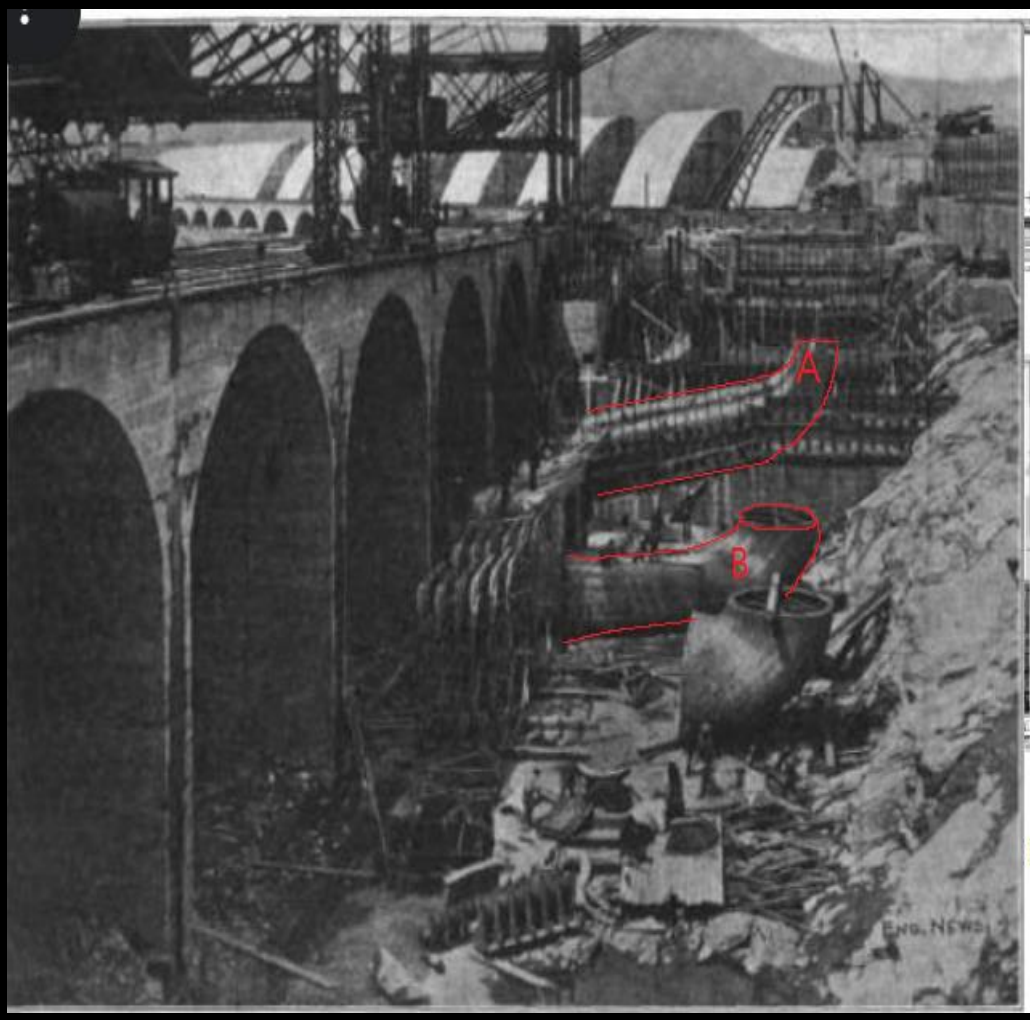
Unknown Facility
Milford, ME

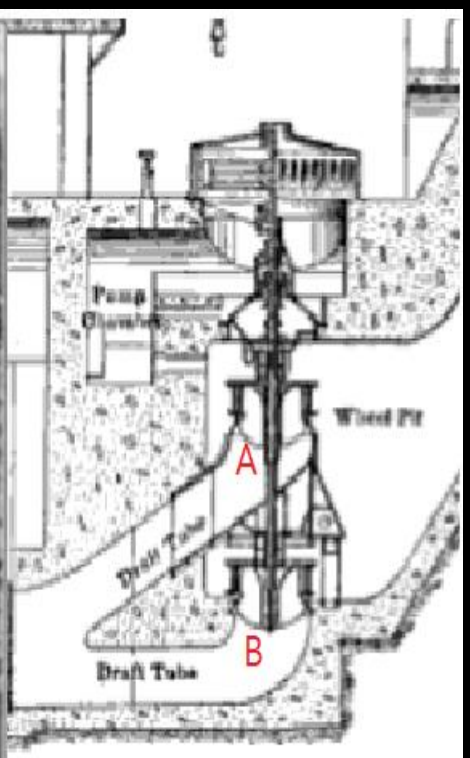


Holtwood Dam,
Pennsylvania

Closing Thoughts

A special thank you to all the members of Turbine Topics, both on Facebook, locally, and on LinkedIn. It is through a group effort that we continue to grow and spread the word of hydropower, uniting both the new and the historically interesting. By sharing knowledge and stories, we keep history alive and possibly inspire the next generation of industry professionals.





Holtwood / McCall Ferry Dam

I.P Morris

References (feature topic)

Water Resources Inventory Report - Commonwealth of Pennsylvania 1917

Electrical World - December 1916 & March 1911

Western Electrician - January 1906

Journal of Electricity, Power and Gas – September 1906

Engineering – May 1913

Power and the Engineer Vol. #34 1911

Electric Power Plants
A Description of a Number of Power Stations Designed by Thomas Edward Murray

Factory and Industrial Management - Volume 31 - 1906

American Hydroelectric Practice - 1917

Decisions of the Commissioner of Patents and of the United States Courts in Patent and Trade-mark and Copyright Cases - 1902

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EST. 2024